Abrasion-Resistant Bumper for a Nail-Driving Tool

Background of the Invention

1. Field of the Invention

The present invention relates to an abrasion-resistant bumper for a nail-driving tool.

2. Description of the Related Art

U.S. Patent No. 4,932,480 to Golsch issued on June 12, 1990 discloses a pneumatically powered nail-driving tool 10 comprising a cylinder 20, a piston 26 reciprocatingly received in the cylinder 20, and a main valve 60 for driving the piston 26. A driving element 32 is attached to the piston 26 for driving a nail. Movement of the piston 26 is arrested by an air-cooled bumper 70 to thereby provide a cushioning effect. As illustrated in Figs. 2 through 5 of this patent, the bumper 70 comprises an upper end 100, a lower end 102, an inner peripheral surface 104, and an outer peripheral surface 106. The bumper 70 has an annular flange 108 extending outwardly at its lower end 102. The annular flange 108 fits into the annular recess 82 in the cylindrical wall 24, when the bumper 70 is fitted within the cylinder 20, so as to secure the bumper 70 against the end wall 24. The bumper 70 has eight slots 110 extending radially from the inner peripheral surface 104 and eight slots 112 extending radially from the outer peripheral surface 106. Arrangement of the slots 110 and 112 in the bumper 70 provides a good bumping effect. However, since the bumper 70 is made of a single resilient or elastomeric material, the face of the bumper 70 that is subject to impact of the piston 26 would become soft and thus loose its impact-resisting effect. In addition, breakage tends to occur between the slots 112 and the slots 110. Further, when the upper end 100 of the bumper 70 is subject to the impact from the piston 26, the bumper 70 is

already in intimate contact with the cylinder 20 and thus has a low cushioning effect, as there is no room allowing further deformation of the bumper 70. Further, during assembly of the bumper 70, the slots 112 of the bumper 70 must be aligned with the ports 80 in the cylinder 20 in order to assure exhaustion of the air in the space 30 below the piston 26 via the ports 80. Difficulty and inconvenience in the assembly procedure are thus caused.

Summary of the Invention

An object of the present invention is to provide an abrasion-resistant bumper for a nail-driving tool comprising a cylinder defining a chamber for reciprocatingly receiving a piston. The bumper comprises a first bumper section and a second bumper section made of a material having a rigidity different from that of the first bumper section. When in a driving stroke of the piston toward the bumper, air in the chamber exits the cylinder via ports of the cylinder.

Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a sectional view of a nail-driving tool in accordance with the present invention.

Fig. 2A is a perspective view of a bumper of the nail-driving tool in accordance with the present invention.

Fig. 2B is a perspective view of the bumper cutting from plane A-A in Fig. 2A.

Fig. 3 is a sectional view similar to Fig. 1, illustrating a driving stroke of the nail-driving tool.

Fig. 4 is a sectional view similar to Fig. 1, illustrating a return stroke of the nail-driving tool.

Detailed Description of the Preferred Embodiment

Referring to Fig. 1, a nail-driving tool in accordance with the present invention is designated by 10 and generally comprises a head 11 defining a compartment 12 for receiving a cylinder 20. Plural ports 13 are defined in an end of the head 11 and communicated with the compartment 12.

Suba2 The cylinder 20 comprises a chamber 21 defined by an inner peripheral wall 211 and an end wall 212. A piston-driving means 22 is mounted in the chamber 21 at a position opposite to the end wall 212. An example of the piston-driving means 22 comprises pressurized air or inflammable gas. An annular connecting wall 213 is provided to interconnect the end wall 212 with the inner peripheral wall 211. A general plane of the annular connecting wall 213 is located at a level different from that of the inner peripheral wall 211. A through-hole 23 is defined in a central portion of the end wall 212. Further, plural ports 214 are defined in the inner peripheral wall 211 and communicated with the compartment 12.

A piston 24 is reciprocatingly received in the chamber 21 and drivable by the piston-driving means 22. A driving element 25 is securely attached to a middle of the piston 24 and extends along a moving direction of the piston 24 to pass through the through-hole 23 in the end wall 212.

Suba3 A bumper 30 is securely mounted in an end of the chamber 21 of the cylinder 20. As illustrated in Figs. 2A and 2B, the bumper 30 comprises a first bumper section 31 and a second bumper section 32 made of a material that is less rigid than that of the first bumper section 31. The second bumper section 32 includes an enlarged end section 321 that abuts against the end wall 211 and

that is securely received in a space defined by the annular connecting wall 213 of the cylinder 20. Further, the remaining portion of the bumper 30 is not in contact with the inner peripheral wall 211 of the cylinder 20, thereby providing a gap therebetween. The bumper 30 has a central through-hole 33 extending through the first bumper section 31 and the second bumper section 32 and aligning with the through-hole 23 in the end wall 212. As illustrated in Fig. 1, the driving element 25 extends through the through-hole 23 in the end wall 212 of the cylinder 20 and the through-hole 33 in the bumper 30.

When in a driving stroke of a nail, referring to Fig. 3, the piston 24 driven by the piston-driving means 22 slides toward the end of the chamber 21 such that the driving element 25 is moved out of the through-hole 23 of the end wall 212 to impact a nail (not shown). A joint area between the piston 24 and the driving element 25 impacts the first bumper section 31 of the bumper 30. Since the first bumper section 31 is more rigid, it provides an excellent abrasion resistance to prevent abrasion of the bumper 30. Since a gap is defined between the inner peripheral wall 211 of the cylinder 20 and the bumper 30 (except the enlarged end section 321 of the second bumper section 32), the second bumper section 32 may deform properly in response to the impact from the piston 24. The air in the chamber 21 exits the cylinder 20 via the ports 214 of the cylinder 20 and the ports 13 of the head 11.

After driving the nail, the piston 24 returns to its initial position. Ambient air enters the compartment 12 via the ports 13 of the head 11 and then enters the chamber 21 of the cylinder 20 via the ports 214, as shown in Fig. 4.

According to the above description, it is appreciated that the bumper 30 in accordance with the present invention is more resistant to abrasion while providing the cushioning effect for the piston 24. This is owing to the first

bumper section 31 and the second bumper section 32 having different rigidities. The gap between the bumper 30 and the inner peripheral wall 211 of the cylinder 20 allows air in the chamber 21 to exit the cylinder 20 during the driving stroke and allows ambient air to enter the chamber 21 of the cylinder 20 during the return stroke. It is not necessary to drill holes in the bumper 30, and the troublesome assembly procedure of aligning the holes of the bumper with the ports of the cylinder in prior art is thus avoided.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the scope of the invention as hereinafter claimed.